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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/582,049	09/18/2000	Marcel Garnier	GARNIER-1	6845

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EXAMINER

NGUYEN, NGOC YEN M

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 05/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/582,049

Applicant(s)

GARNIER ET AL.

Examiner

Ngoc-Yen M. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 7-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 11 and 12 is/are allowed.
- 6) ☒ Claim(s) 1-4 and 7-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 28, 2005 has been entered.

Claims 11-12 are allowed.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

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consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yuge et al (5,182,091) in view of DE 29 24 584, Hanazawa et al (6,231,826) and optionally further in view of Aratani et al (5,961,944).

Yuge '091 discloses a method for purifying silicon which comprises directing a plasma jet of an inert gas toward the surface of molten silicon held in a container lined with silica or a silica based refractory and stirring said molten silicon, said inert gas being mixed with 0.1-10 vol% steam (note claim 1). Yuge '091 discloses that it was found by small scale experiments that the adequate stirring of molten silicon reduces the loss of silicon below 10% during the purification process even though the amount of steam added to the plasma gas is increased to 10 vol%. Thus the stirring of molten silicon is essential. A better result is obtained when induction heating is applied to the molten silicon (note column 3, lines 37-44). Thus, Yuge '091 fairly teaches that induction heating is carried out not only to melt the silicon but also during the plasma treating step to improve the stirring of the molten silicon.

Yuge '091 discloses that although the process employs a plasma torch, which generates an arc therein, it is possible to make modification by applying the voltage across the plasma torch and the molten silicon (note column 3, lines 1-4).

The differences are (1) Yuge '091 does not specifically disclose plasma, which is generated by an inductive plasma torch and (2) Yuge '091 does not disclose the use of a "cold" crucible.

For difference (1), DE '584 discloses a process of producing silicon for solar cells by introducing silica or Si with a higher degree of contamination into a reducing gas atmosphere in a plasma. The plasma is preferred to be an inductive plasma instead of an arc torch in order to avoid contaminating the molten silicon (note English abstract and page 4, last full paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made use an inductive plasma instead of an arc plasma, as suggested by DE '584, in the process of Yuge '091 because the use of the inductive plasma would avoid contaminating the molten silicon.

For difference (2), Yuge '091 discloses that purification is accomplished by the removal of boron and carbon in the form of oxides. Oxygen to form oxides is furnished from the container wall of silica or silica-based refractory as the molten silicon is stirred. However, Yuge '091 further teaches that for more rapid carbon removal, it is desirable to add an oxidizing gas and/or silica powder to the plasma gas at the exit of the plasma torch (note column 2, lines 45-68).

Hanazawa '826 discloses a process for refining silicon (note title and claim 1). Hanazawa '826 teaches that high purity silicon having a purity of 00.9999% (6N) or more is required for use as a raw material for solar batteries (note column 1, lines 25-39). Hanazawa '826 further teaches that it is known in the art to use copper vessel,

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cooled with water, to prevent contamination caused by vessel materials (note column 1, lines 48-51 and column 2, lines 13-27). Hanazawa '826 also teaches that instead of the water-cooled copper vessel, a graphite vessel can be used because graphite vessel would improve heat efficiency, prevents contamination and is inexpensive (note abstract and column 3, lines 13-36). As shown in Figure 3, a solid state silicon layer 9 is formed at the bottom of the graphite vessel 9 (note column 9, lines 27-28), thus, the graphite vessel as disclosed in Hanazawa '826 is considered the same as the claimed "cold" crucible.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a "cold" crucible, either a water-cooled copper vessel or a graphite vessel, as suggested by Hanazawa '826 for the process of Yuge '091 because such vessel would prevent contamination caused by vessel materials. It should be noted as the purity for silicon is required to be higher, as suggested by Hanazawa '826, the use of silica vessel as disclosed in Yuge '091 would no longer capable of producing silicon with the required purity, one skilled in the art would have been motivated to switch to "cold" crucible as suggested by Hanazawa '826 and still achieve the goal of purifying the silicon as set out in Yuge '091 by adding oxidizing gas and silica (note column 2, lines 53-56) to provide the source of oxygen instead of the silica from the retainer walls.

Optionally Aratani '944 can be applied to teach that it is known and conventional in the art to melt silicon in a retaining container made of graphite or a water-cooling

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retaining container made of copper. The heating may be conducted by gas heating or electric heating (note column 5, lines 42-48).

Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yuge '091 in view of DE '584, Hanazawa '826, and Hiratake et al (4,048,436), optionally further in view Aratani '944.

Yuge '091, DE '584, Hanazawa '826 and optionally, Aratani '944 are applied as stated above.

Yuge '091 fairly teaches the inductive crucible and DE '584 the inductive plasma torch. Yuge '091 also disclose a bottom opening 13 (note Figure 4). The silica 1a in the bottom opening 13 is kept cooled and solidified, and it permits the electric current to flow to the water cooled electrode. This considered the same as the claimed electromagnetic valve.

The difference is Yuge '091 does not disclose a removable magnetic yoke between the plasma torch and the crucible.

Hiratake '436 discloses that an inductively produced plasma can be enlarged by subjecting the plasma to the rotating magnetic field generated by the rotating magnetic field generating means 44e. Because the plasma is more heated at its surface rather than its interior by induction heating on account of the skin effect, the rotating magnetic field has an effect to heat the surficial portion rather at a low temperature by its nature besides the enlargement of the plasma. This effect further contributes to the homogeneous heating of the plasma (note Figure 10 and column 6, lines 24-55).

For the “for inverting a stirring direction of the silicon load” limitation, when this limitation is considered as a “means plus function” limitation, and based on the instant disclosure, such means is required to have a specific shape and property (i.e., a ring shape magnetic yoke), thus, the magnetic ring shape means “44e” (as shown in Figure 10) of Hiratake ‘436 is considered as the required means for inverting the stirring direction. Alternatively, since the means in the instant claim 9 already is required to have the ring shape yoke and being magnetic, the limitation “for inverting a stirring direction” is considered as an intended use limitation. Such limitation is given little weight, In re Hack 114 USPQ 162. Furthermore, since the magnetic ring shape means as disclosed in Hiratake ‘436 has all the positive limitations as those of the required means, it would be capable of performing the same function.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made enlarge the plasma in Yuge ‘091, by using a rotating magnetic field, as suggested by Hiratake ‘436, because an enlarged plasma with a wide and homogeneous temperature distribution can be obtained and the wider the plasma the more surface it can treat.

Applicant's arguments filed October 28, 2005 have been fully considered but they are not persuasive.

Applicants argue that Applicants' claims require a cold crucible.

Hanazawa '826 and Aratani '944 are now applied as stated above to teach the use of cold crucible for melting silicon to prevent contamination caused by the vessel materials.

Applicants argue that Yuge '091 does not teach or suggest "causing the silicon melt from a bottom of the crucible to ascend along a central axis thereof to a free surface of the silicon melt, to turbulently stir the silicon melt."

From Figure 1 of Yuge '091, the arrows fairly disclose that the molten silicon is stirred so that the silicon from the top would descend to the bottom and then back on top again along a central axis as required in Applicants' claims. Yuge '091 further teaches that the "electric current intensifies the stirring" (note column 3, lines 16-20) which fairly suggests "turbulently stir".

Applicants argue that Hiratake does not disclose that the rotating magnetic field generating means 44e is removable.

It should be noted that the shape of the rotating magnetic field generating means 44e in Hiratake is the same as that of the claimed magnetic yoke, thus, the means 44e in Hiratake would be as "removable" as that of the claimed magnetic yoke.

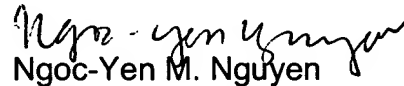
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner is currently on Part time schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Stanley Silverman can be reached on (571) 272-1358. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 or (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed (571) 272-1700.


Ngoc-Yen M. Nguyen
Primary Examiner
Art Unit 1754

nmn
March 17, 2006